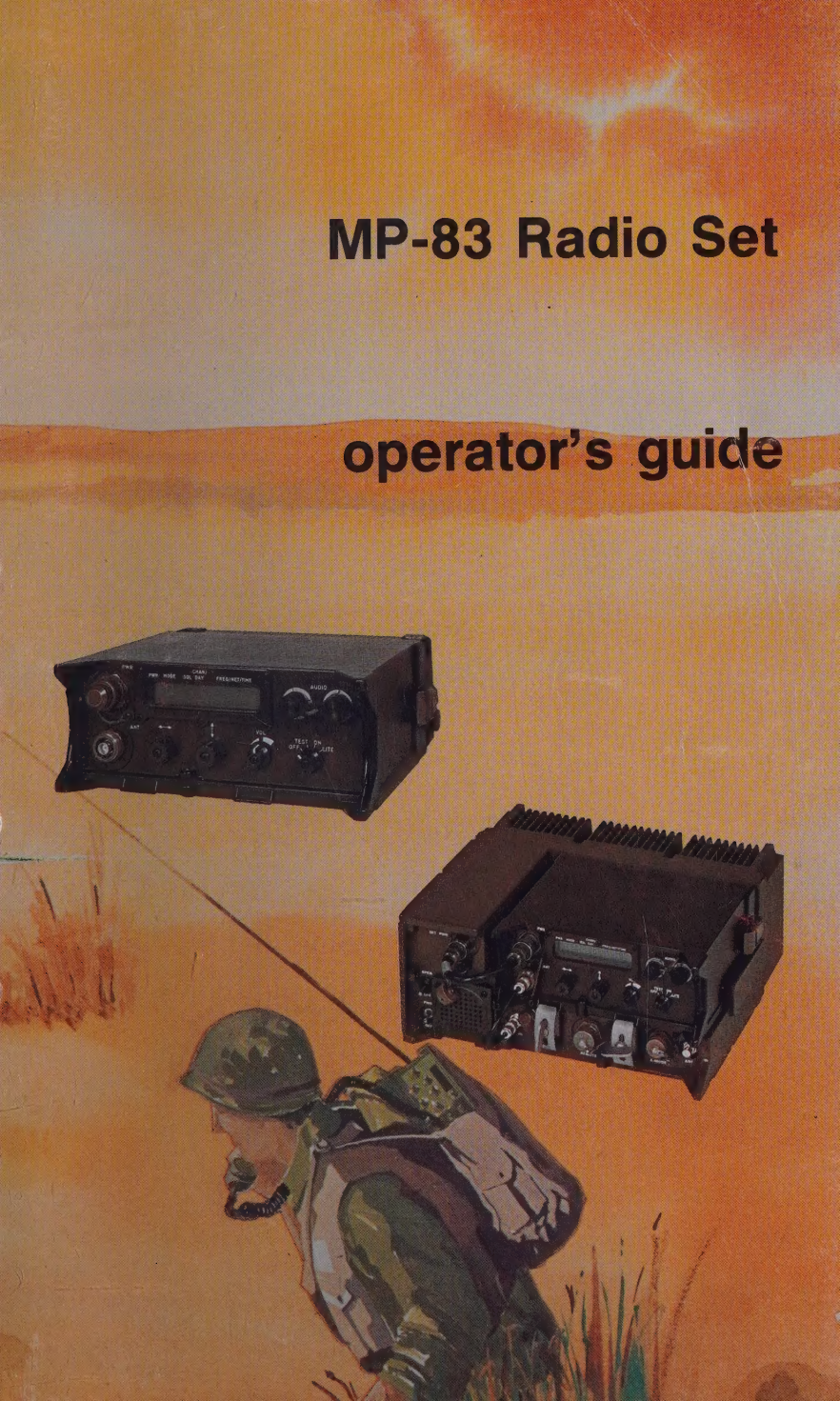
MP-83 Radio Set

operator's guide



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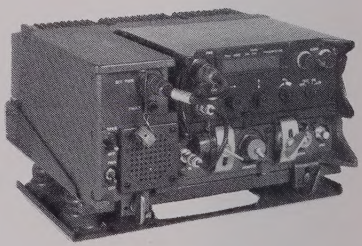


VEHICULAR

TPA-6192-017

MP-83 Radio Set

INTRODUCTION

The MP-83 Tactical VHF-FM Radio Set is a state-of-the-art man-pack or vehicular radio set with electronic counter-countermeasures (ECCM) capabilities.

All controls for the MP-83 Radio Set are on the front panel of the 628K-1 Receiver-Transmitter and have been designed for ease of operation and minimal operator training. The radio set provides voice reception and transmission at a transmit power level of 5 watts or 0.25 watt. When the radio set is installed in the 648W-1 Vehicular Power Amplifier, the transmit power level is increased to 50 watts.

The MP-83 Radio Set has two main modes of operation: fixed frequency (NO HOP) and frequency hopping (HOP). The remaining selectable modes — channel scanning (SCAN), net control station (NCS), and time (TIME) — are used in conjunction with either fixed frequency (NO HOP) or frequency hopping (HOP). Channel scanning (SCAN) is used in conjunction with fixed frequency (NO HOP). Net control station (NCS) and time (TIME) are used in conjunction with frequency hopping (HOP).

A feature of the MP-83 Radio Set is the built-in test (BIT) which provides fault isolation to the module level and identifies low battery power and antenna faults. Operational status of the radio set is provided to the operator by a liquid crystal display (LCD).

MODES OF OPERATION

Modes of operation for the MP-83 Radio Set are as follows.

- Fixed frequency (NO HOP) provides 2320 channels at 25-kHz spacing from 30 to 87.975 MHz. These may be selected manually or loaded into one of nine operator-selectable preset channels.

- Channel scanning (SCAN) provides frequency scanning in fixed frequency (NO HOP) only and is compatible with vhf-FM-type radio sets with 150-Hz tone squelch. The radio set scans four preset channels: one preset channel as selected by the operator, plus three additional preset channels — 7, 8, and 9.

- Frequency hopping (HOP) provides 800 net identifiers (000 to 799) that may be selected manually or loaded into one of nine selectable preset channels for frequency hopping with other MP-83 Radio Sets. Frequency hopping provides electronic counter-countermeasures (ECCM) capability for communications defense (jammer evasion) against opposing forces electronic warfare (EW) activities.

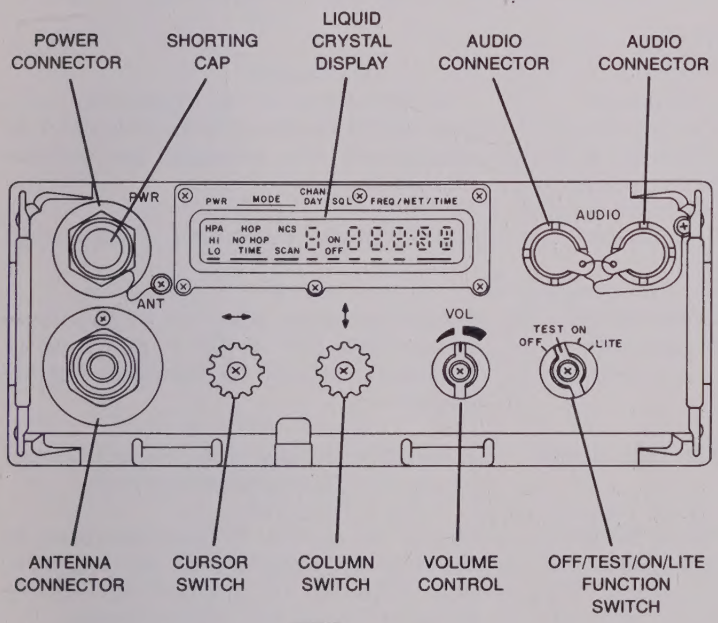
- Net control station (NCS) is utilized only in the HOP mode. One radio set within each net is designated NCS and will have NCS selected on its display. Each time the NCS transmits, it automatically maintains time within the net.

- Time (TIME) displays time and provides the means to transfer time from one radio set to another. The proper time is necessary in all radio sets to establish a frequency hopping net.

OPERATION, MAN-PACK

Controls, Indicators, and Connectors

The operating controls, indicators and connectors (except for input power from the battery) are located on the front panel of the 628K-1 Receiver-Transmitter.



POWER connector — Provides the power interface for the receiver-transmitter and the audio interface for intercom systems when installed in a vehicle. Also provides data interface for 16 kb/s data.

Shorting cap	Straps battery-pack power into the 628K-1 Receiver-Transmitter. Must be attached in the man-pack configuration.
Liquid crystal display	Displays PWR, MODE, CHAN/DAY, SQL, and FREQ/NET/TIME with function switch in ON position, and fault information when function switch is in TEST position. Display batteries and receiver-transmitter faults in the NO HOP, HOP, and TIME modes.
AUDIO	
Connector	Five-pin connector for interfacing audio external device. Provides transmit audio in, receive audio out, retransmit, and push-to-talk (ptt) key lines.
Connector	Provides parallel connection to above audio connector.
OFF/TEST/ON/LITE function switch	Permits operator to select one of three functions — OFF, TEST, or ON — with a spring-loaded LITE position for illumination of the display.
VOLUME control	Permits the operator to set the audio output for the most desirable listening level.
Cursor switch ↔	Permits the operator to move the cursor on the liquid crystal display under the function or digit (PWR, MODE, CHAN/DAY, SQL, or FREQ/NET/TIME) that requires change.

Column switch ↕

Permits operator to change the following functions in each column of the liquid crystal display:

PWR: Either HI or LO

Note

HPA is used only in the vehicular configuration.

CHAN/DAY

CHAN: 1 through 9, CHAN is automatically displayed when HOP or NO HOP is selected. CHAN 0 is used for special functions (refer to operating procedures on page 21).

DAY: 1 through 7, DAY is automatically displayed when the TIME mode is selected. DAY 0 is used for special functions (refer to operating procedures on page 28).

SQL: Either ON or OFF

FREQ/NET/TIME: 30.000 through 87.975 when NO HOP is selected. 000 through 799 when HOP is selected. 00:00 through 23:59 when TIME is selected.

ANTENNA connector

Rf input/output connector, for direct mounting of man-pack antenna or for connecting coaxial cable.

Preoperational Procedures

Configure the MP-83 Radio Set for operation in the following manner.

Installation/Replacement of Battery

- Set the function switch on the front panel of the 628K-1 Receiver-Transmitter to OFF.
- Remove the MP-83 Radio Set from harness by releasing the two holding straps.
- Situate the radio set so that the battery-box may be removed.
- Release the two latches on the receiver-transmitter and remove battery-box.
- Carefully pull on the battery until it separates from the base of the receiver-transmitter.
- Place the new battery in position, being careful to align the socket on the battery with jack on the base of the receiver-transmitter.
- Gently push battery into place.
- Replace the battery-box and secure with two latches on the receiver-transmitter.
- Remount the radio set in the harness and tighten the two holding straps.

Note

The MP-83 Radio Set may be powered by any 12.5-volt battery that is compatible with the AN/PRC-77 Radio Set, such as BA-5598/U, BA-5386/U, BA-386/PRC-25, or BA-4386/U.

Installation of Antenna

- Ensure the function switch on the front panel of the receiver-transmitter is in the OFF position.

- Mount the 938X-1 Broadband Antenna on the ANT connector located on the front panel of the receiver-transmitter and rotate the base of the antenna clockwise until tight.

Installation of Handset

- Place the handset connector on AUDIO connector located on the front panel of the receiver-transmitter. Ensuring the keying on the plug matches the keying on the receptacle, push and turn clockwise until connector snaps into place.

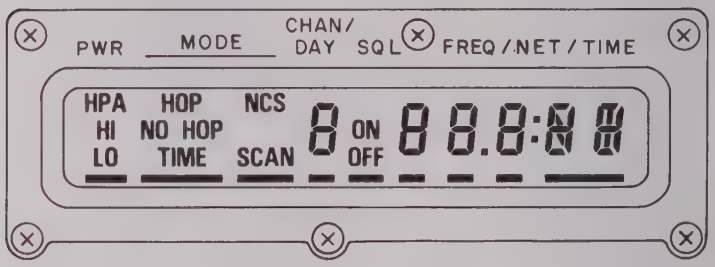
To verify configuration and radio set performance, set function switch to TEST and refer to built-in test (BIT).

Built-In Test (BIT)

Receive

Set function switch to TEST.

Display shows all segments of the LCD for 3 seconds.

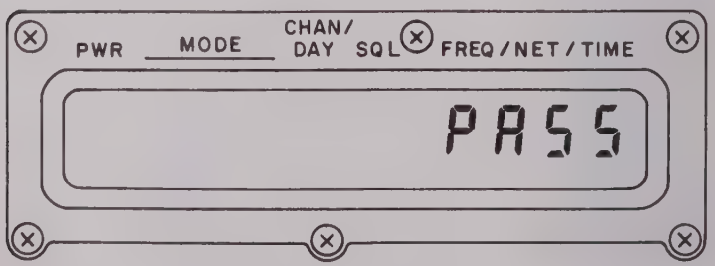


TPA-6166-011

If the receiver is operating properly, the word PASS will be displayed immediately following the 3-second period.

Note

Information on the left-hand portion of the display is not relevant to the built-in test (BIT) but is merely information retained by the memory of the radio set.



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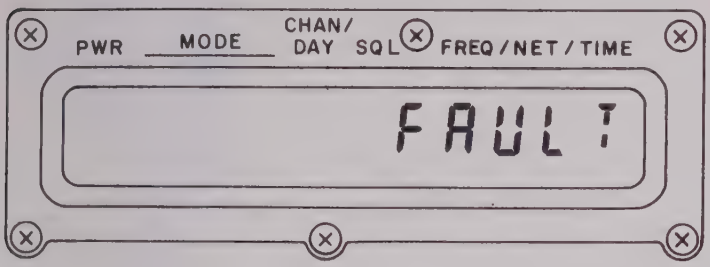
If a fault is detected, the LCD will display faults in the following manner:



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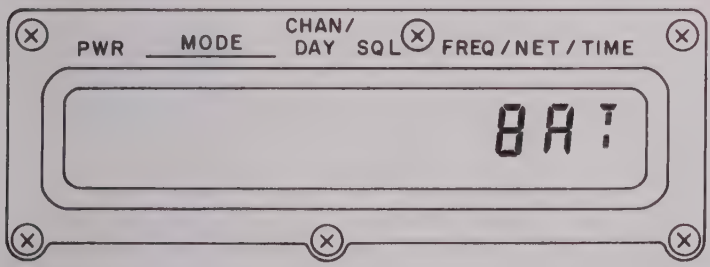
FAULT is displayed alternately with the indicated fault (example: FAULT, BAT, FAULT.....).



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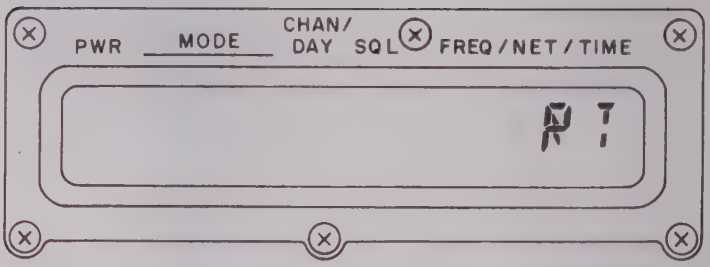
FAULT CONDITION	ACTION
Battery voltage is less than 10 V dc.	Replace battery.



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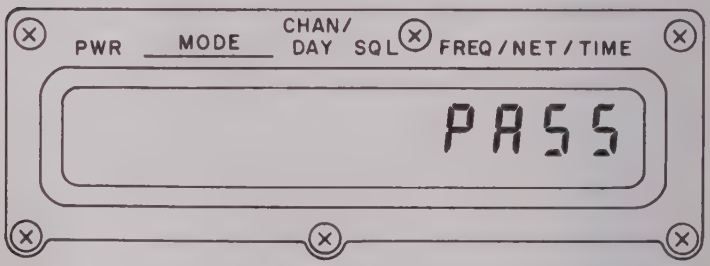
FAULT CONDITION	ACTION
Receiver-transmitter is inoperative.	Return for repair.

Transmit

If the push-to-talk (ptt) button on the handset is pressed while in the test mode, the transmit section will be checked.

The LCD will display the word PASS if no fault is detected.



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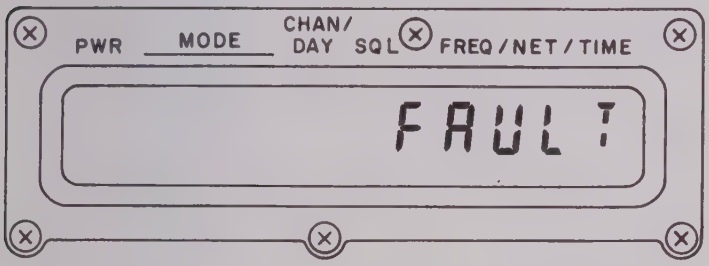
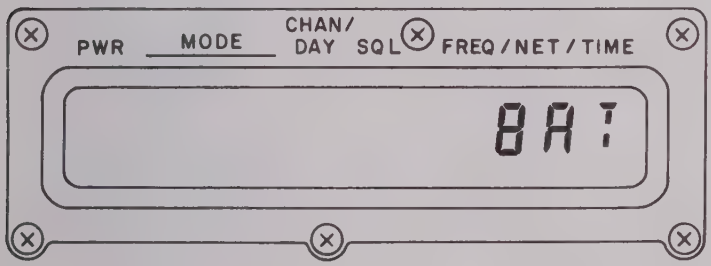
If a fault is detected, the LCD will display faults in the following manner:



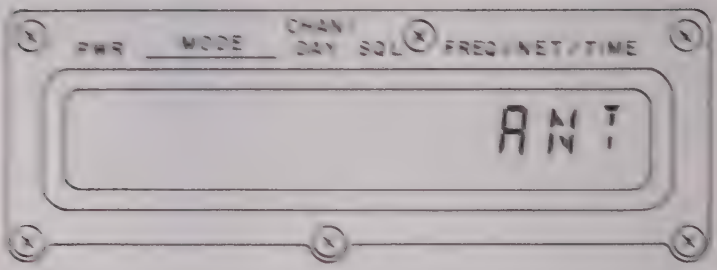
TPA-6322-011

FAULT is displayed alternately with the indicated fault (example: FAULT, RT, FAULT.....).



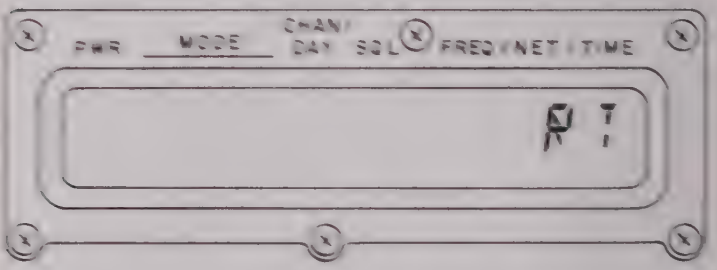
TPA-6321-011

FAULT CONDITION	ACTION
Battery is less than 10 V dc.	Replace battery.



TPA-6319-011

FAULT CONDITION	ACTION
Antenna performance has been degraded.	Check physical condition of antenna.



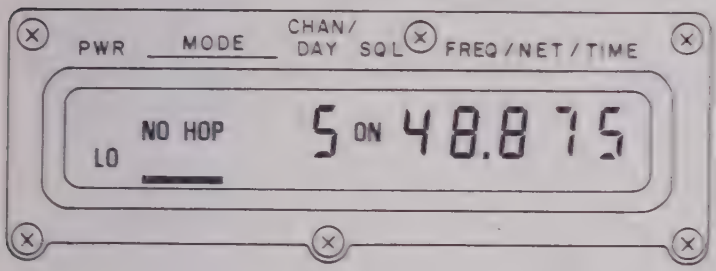
TPA-6320-011

FAULT CONDITION	ACTION
Receiver-transmitter is inoperative.	Return for repair.

Note

Functions called out in the procedures are selected by using the cursor and column switches. To select a function to be changed, first rotate the cursor switch (↔) to position the cursor under the desired function, either PWR, MODE, CHAN/DAY, SQL, or FREQ/NET/TIME. Once the cursor is positioned under the desired function, rotate the column switch (↕) to select the desired operation under that function. An example would be to first rotate the cursor switch to position the cursor under the PWR function and to then rotate the column switch to select either HI or LO power.

Fixed Frequency (NO HOP)



TPA-6318-011

- Set function switch to ON.
- Set PWR to LO.
- Select NO HOP mode.
- Set SQL to ON.
- Set CHAN to 1.
- Use the cursor and column switches to set the desired frequency (30.000 to 87.975 MHz) in the display.
  This frequency is now loaded in preset channel 1.
  Set CHAN to 2.
- Use the cursor and column switches to set the next desired frequency (30.000 to 87.975 MHz) for channel 2.
  This frequency is now loaded in preset channel 2.

To load the remaining 7 preset channels (3 through 9), first select the channel (3, 4, 5, 6, 7, 8, 9) to be loaded; then with the use of the cursor and column switches, select the desired frequency (30.000 to 87.975) for each channel as described above.

If, at a later time, a preset frequency needs to be changed, select the channel to be changed and input the new frequency by using the cursor and column switches. Preset channels are stored in memory and are not lost when the radio set is turned off.

Receive

- Select the desired CHAN.
- Listen to the handset for channel activity and adjust volume control as desired.

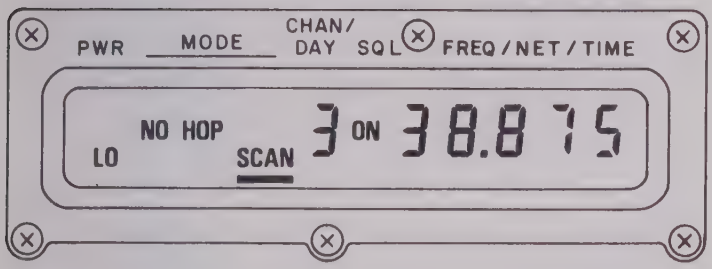
Transmit

- Press the push-to-talk (ptt) button on the handset.
- Talk in a normal volume with mouth touching handset.
- Release push-to-talk (ptt) button when message is complete.

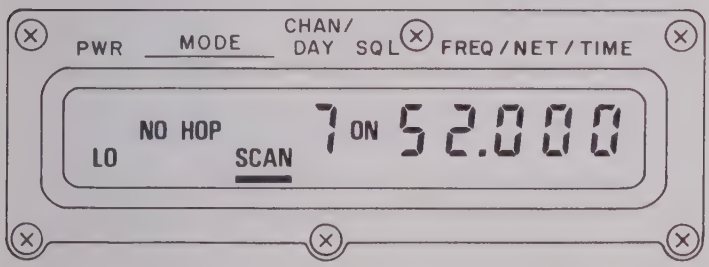
When communicating with MP-83 Radio Sets or other vhf-FM-type radio sets having a 150-Hz tone squelch, the SQL should be set to ON. This eliminates the loud noise in the handset when no station is being received. If communication is required between the MP-83 Radio Set and a radio set that does not have a 150-Hz tone squelch, the SQL should be set to OFF.

PWR should be set to LO for short-range (less than 1 km (0.62 mi)) communications. Set PWR to HI for maximum range (8 km (4.97 mi)) communication. Maximum battery life is obtained when PWR is set to LO.

If the operator wishes to manually select an operating frequency, position the cursor under each digit and alter accordingly with the column switch. It should be noted that any alteration of a particular frequency changes the preset frequency of that channel. Therefore, it is suggested that a list of the preset channels be kept by the operator in case an alteration of the preset frequencies is required.



TPA-6234-011



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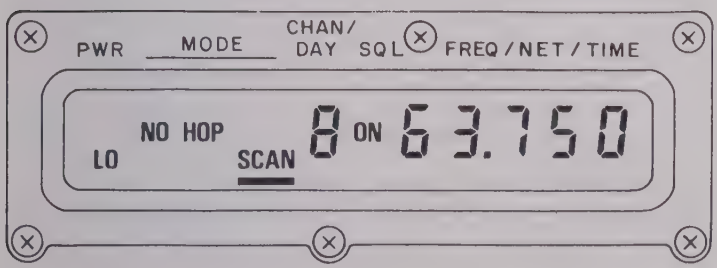

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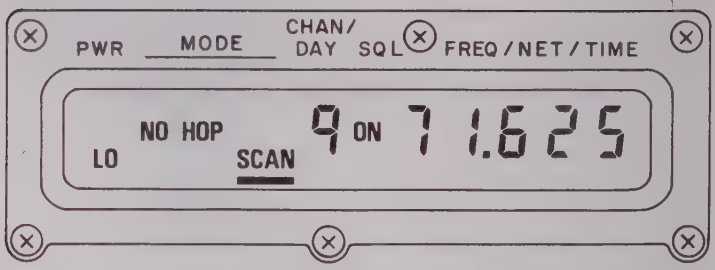

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- Set function switch to ON.
- Set PWR to HI or LO.
- Select NO HOP mode.
- Verify that preset channels 7, 8, and 9 are loaded with the desired channel frequencies.
  SQL is automatically set to ON when the SCAN mode is selected.
- Select CHAN for the desired preset command (primary operating) channel (1 through 9).
- Select SCAN mode.

In the SCAN mode, the selected preset command channel, along with preset channels 7, 8, and 9, is scanned. When a signal is received, the receiver will lock on that station and remain until 3 seconds after the station stops transmitting, then resume scanning. During reception on a preset other than the command channel, the receiver continues to automatically monitor the command channel. Should activity be detected on the command channel while receiving on a different preset channel, a beep tone will be heard in the operator's handset once every second. To listen to the command channel, the operator must abort reception on the other preset channel by pressing and releasing the push-to-talk (ptt) button on the handset. SCAN will then retune his radio set to the command channel in the receive mode.

The operator may respond to a preset channel (7, 8, 9) by pressing the push-to-talk (ptt) button on the handset within 3 seconds after receiving a message. After transmission, the radio will resume scanning.

The operator may transmit on the command channel at any time while in the SCAN mode. Any time the receiver is scanning or receiving a message with no beeping tone, pressing the push-to-talk (ptt) button on the handset will cause a transmission on the command channel. If the receiver is within the 3-second timeout or receiving a channel with a beeping tone, a second pressing of the push-to-talk (ptt) button on the handset is required to cause transmission on the command channel. All transmissions on the command channel are preceded with a sidetone beep in the headset. Any change of the display cursor or column switches will abort SCAN and return the display to the command channel selected prior to SCAN.

By loading the same frequency in more than one preset channel, it is possible to reduce the number of channels (frequencies) scanned.

Frequency Hopping (HOP) — Introduction

Operation of MP-83 Radio Sets in frequency hopping (HOP) mode requires the use of net identifiers which are similar to disciplines typically exercised in military communication nets. The net may consist of two or more members, one of which is designated the net controller. The net controller has responsibility for establishing and controlling the communications nets. The procedures of setting up a fixed frequency (NO HOP) net are the same with MP-83 Radio Sets as they are with any family of fixed frequency radio sets, such as the PRC-77 Radio Set and the VRC series of equipment. The net controller has the added responsibility of establishing and maintaining net time for the frequency hopping (HOP) net. In a fixed frequency (NO HOP) net, all radios must be set up to operate on the same frequency. In a frequency hopping (HOP) net, all radios must be set up to operate with the same frequency hopping pattern and with the same time reference. The frequency hopping (HOP) pattern is determined by the net identifier and key number. The time reference is the time maintained in each radio by the internal clock.

The procedures for loading net identifiers and loading the key number are given on pages 20 and 21. The net controller is responsible for coordinating the setting of all radio set internal clocks to a common time (net time). Two techniques for setting time in a radio set are available; one is a manual time loading similar to setting a watch, page 21, and the other is a procedure for transferring time from one radio set to one or more radio sets through a radio transmission, pages 27 and 28.

The net controller may use one or a combination of both time entry techniques to set time in his radio set and to set the same time in all the radio sets that are to be members of the frequency hopping net. (Note: If manual time setting is used, an accuracy of ±10 seconds must be achieved.)

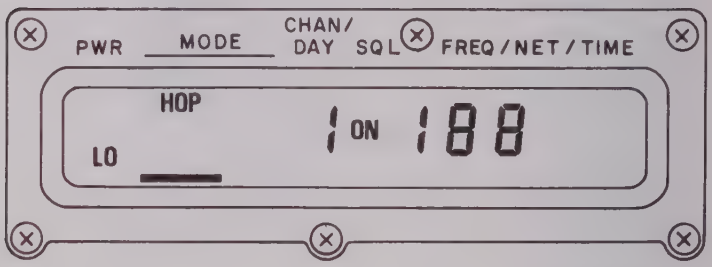
After a frequency hopping net is set up, the net controller must maintain time within the net so that net members will not lose the ability to communicate in the net due to the internal clock of the radio set operating too fast or too slow and developing a time error in excess of ±10 seconds. The net controller will maintain time throughout the net by setting his radio set in the net control station (NCS) mode, page 23. (NCS mode can only be selected in HOP mode.) Each time the net controller transmits a message, all receivers receiving that message will automatically receive a time update, resetting their internal clocks. No other action is required to maintain net time.

A non-net member may contact the net controller of the hopping net by transmitting on the fixed frequency, which is the assigned PAGE frequency of the hopping net. An alert signal will be provided to the net controller in the hopping net and, by switching from HOP mode to NO HOP mode, the net controller can communicate with the non-net member on the page frequency. A non-net member equipped with an MP-83 Radio Set may request a radio-to-radio time transfer, load the proper net identifier and key number, and join the hopping net.

Frequency Hopping (HOP)

Before MP-83 Radio Sets can communicate with each other in the HOP mode, all radio sets must be set up with a common 3-digit net identifier, a common 4-digit key number, and common time (within ±10 seconds).

Setting Net Identifier

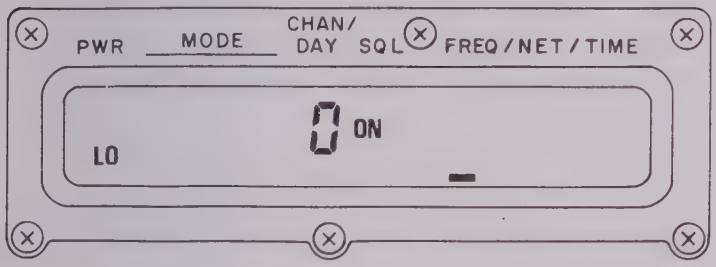


TPA-6236-011

- Set function switch to ON.
- Set PWR to HI or LO.
- Select HOP mode.
- Set CHAN to 1.
- Using the cursor and column switches, select the net identifier (000 to 799) for channel 1.
- Set CHAN to 2.
- Using the cursor and column switches, select the net identifier (000 to 799) for channel 2.

To load the remaining 7 channels (3 through 9), first select the channel (3, 4, 5, 6, 7, 8, 9) to be preset, then by using the cursor and column switches, select the net identifier (000 to 799) for each channel. Load page frequency assigned to each hopping net identifier in the associated fixed frequency preset channel.

Key Number Loading



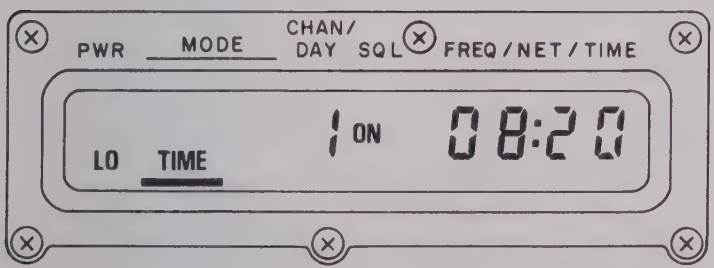
TPA-6747-011

- Set CHAN to 0.
  No digits will be displayed on the liquid crystal display when channel 0 is first selected.

- Rotate the cursor and column switches to set the key number (0000 to 9999).

The key number loaded is common for all preset channels (1 through 9). Should it be necessary to change the key number, set CHAN to 0 and, by using the cursor and column switches, load the new key number.

Manual Time Loading



TPA-6316-011

- Select TIME mode.

- Set DAY (1 through 7).

- Set hour (00 through 23).
- Set minute (00 through 59) to within 1 minute of desired time.
- As the time source starts a new minute, rotate the column switch to set the new minute on the radio set. Seconds are reset to 00 automatically every time the minute number changes.
- Time is now entered in the radio set.

The time source will be designated by the net control station (NCS). For automatic transfer of time, use procedure for TIME on page 27.

Net Control Station (NCS)

One station within each frequency hopping net is designated net control station (NCS) and must have NCS mode selected. The NCS has the responsibility of establishing, maintaining, and controlling the net.

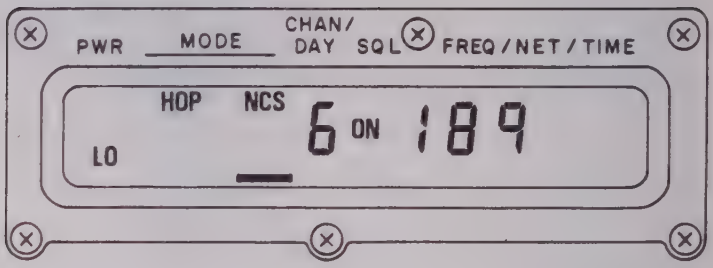
To establish a net, the NCS may either designate a time source to be manually loaded into the net radio sets, page 21, or use the TIME procedure, page 27, to automatically transfer NCS time into the net radio sets.

To maintain net time, the NCS must communicate with the net periodically. All non-NCS radio sets will automatically have their time updated after receiving normal communication from the NCS. Net time may be maintained for 48 hours without NCS update.

To control the net, the NCS is the only radio set having the capability to recognize PAGE messages received from non-hopping radio sets. Refer to the NCS radio set receiving PAGE procedures on page 26. If late net entry is requested, the NCS has the option of bringing the requester into the net using TIME procedures, page 27.

If NCS receives a transmission from another NCS, or from a net member who has inadvertently selected NCS, a "beep" will precede the message to alert the NCS operator. The time in either radio set will not be updated or altered.

Radio Set in HOP, NCS Mode



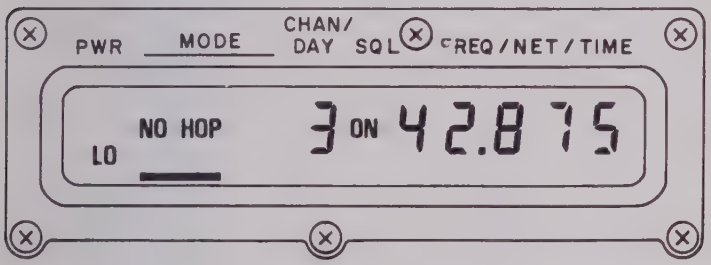
TPA-6235-011

- Set function switch to ON.
- Set PWR to HI or LO.
- Select HOP mode.
- Select CHAN 0.
- Select NCS mode.
- Select preset channel (1 through 9).
- Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit, and releasing the button to receive.

Paging a Net Control Station Radio Set (PAGE)

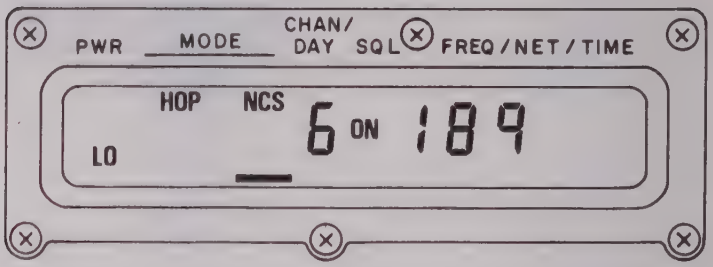
Paging is used by a radio set in NO HOP to request communications with the net control station (NCS) of a hopping net.

Radio Set Transmitting PAGE

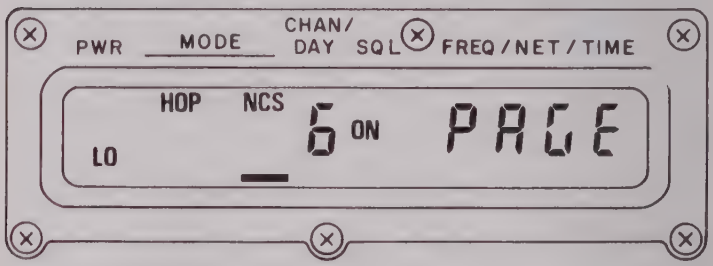


TPA-6238-011

- Set function switch to ON.
- Set PWR to HI or LO.
- Select NO HOP mode.
- Select preassigned page channel.
- Set SQL to ON or OFF.
- Press push-to-talk (ptt) button on handset for approximately 3 seconds to initiate paging.
- Voice communication is not necessary. Allow time for NCS or designated net member to respond in NO HOP mode. If late net entry is desired, follow time procedure of Radio Set Requesting/Receiving Time, page 28.



TPA-6235-011



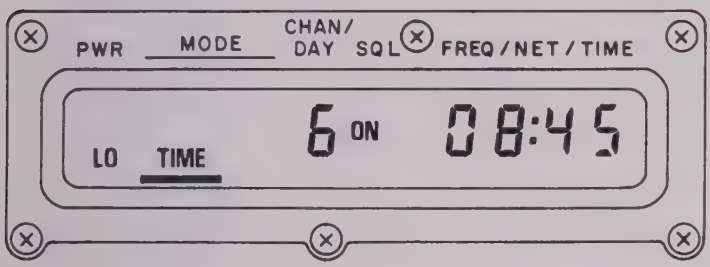
TPA-6239-011

The word PAGE is observed flashing alternately with the net identification number on the LCD. A beeping tone (2 kHz) cycles every 12 seconds if SQL is ON.

- Select the NO HOP mode to communicate with other operator on page channel.
- If late net entry is desired by pager, follow TIME procedure of Radio Set Transmitting Time, page 27.
- To remove tone, set SQL to OFF. The word PAGE will continue to flash as long as paging activity persists. Pressing the push-to-talk (ptt) button on the handset overrides the PAGE indication while transmitting.

Transfer of time in this mode requires that both the radio set sending time and the radio set or radio sets receiving time must first be set up to operate on the same frequency in NO HOP mode and then switched to TIME mode. This coordination may be accomplished using fixed frequency communication or any other available signaling techniques.

Radio Set Transmitting Time



TPA-6237-011

- Set function switch to ON.
- Set PWR to HI or LO.
- Select NO HOP mode.
- Set to preassigned page frequency.
- Establish voice communication with time requester or coordinate by any available means.
- Select TIME mode.

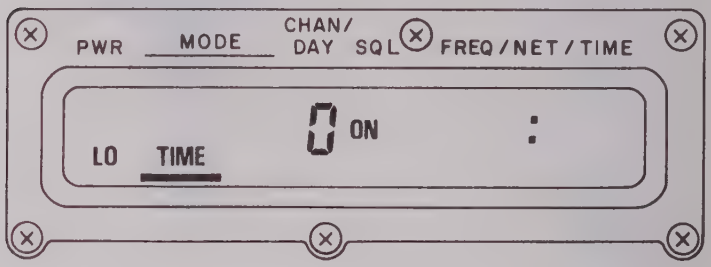
Note

When unit is in TIME mode, it will receive TIME mode transmissions only, and not HOP or NO HOP mode communications.

- Transmit a message to time requester. Time is automatically updated in the requester's radio set at the end of transmission.
- Continue voice communication in TIME mode to confirm time was received and coordinate switching to HOP mode.
- Select HOP mode.

- Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit, and releasing the button to receive.

Radio Set Requesting/Receiving Time

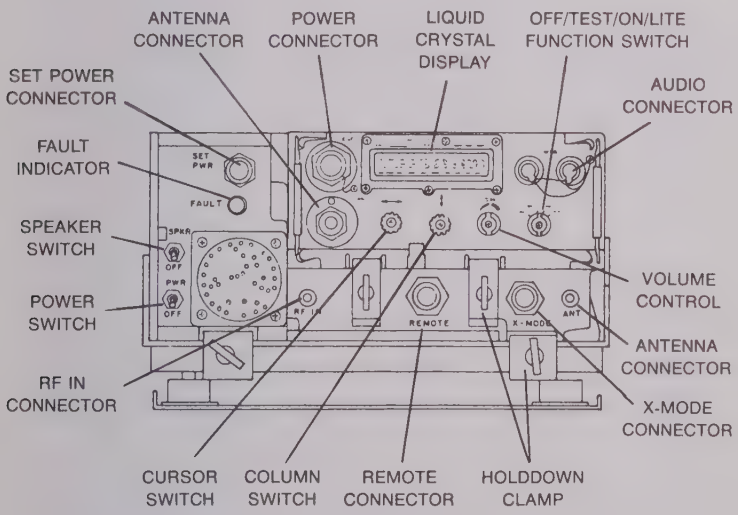


TPA-6317-011

- Set function switch to ON.
- Set PWR to HI or LO.
- Select NO HOP mode.
- Set to preassigned page frequency.
- Establish voice communication with another operator and request time update or coordinate by any other means.
- Select TIME mode.
- Set DAY to 0. Time display will be blank except for colon.
- Proceed with voice communication. The radio set will be updated at the beginning of the time transmitter's transmission, but time will not be displayed until the end of his transmission.
- Acknowledge to transmitter that time has been received and coordinate switching to HOP mode.
  Continued two-way voice communication is possible without changing time in either radio set.
- Select HOP mode.
- Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit, and releasing the button to receive.

Controls, Indicators, and Connectors

The operating controls, indicators, and cable/antenna connectors are located on the front panels of the 628K-1 Receiver-Transmitter and the 648W-1 Vehicular Power Amplifier. The power/control plug on the rear of the 648W-1 Vehicular Power Amplifier mates directly with the MT-1029 Equipment Mounting Base.



648W-1 Vehicular Power Amplifier

SET POWER connector — Provides power, transmit audio in, receive audio out, remote data in/out, normal audio inhibit, retransmit, and push-to-talk (ptt) key lines between the receiver-transmitter and the vehicular power amplifier.

FAULT indicator	Indicates detected faults when push-to-talk (ptt) button is pressed (receiver-transmitter PWR must be set to HPA). Fault indicator is reset when push-to-talk (ptt) button is released.
SPEAKER switch	Determines use of loudspeaker.
POWER switch	Main power switch for vehicular power amplifier and receiver-transmitter. Circuit-breaker type switch will trip in the event of an overcurrent condition.
RF IN connector	Rf input/output connector, provides interface from antenna connector on receiver-transmitter through coaxial cable.
REMOTE connector	Provides for remote control of receiver-transmitter functions.
X-MODE connector	Provides transmit audio in, receive audio out, and key lines for secure voice communications.
ANTENNA connector	Rf input/output connector for connecting coaxial cable from vehicular power amplifier to base of broadband antenna.
Holddown clamps	Secures the 628K-1 Receiver-Transmitter to the vehicular power amplifier, and the 648W-1 Vehicular Power Amplifier to the vehicular mount.

628K-1 Receiver-Transmitter

POWER connector	Provides the power interface for the receiver-transmitter and the audio interface for intercom systems when installed in a vehicle. Also provides data interface for 16 kb/s data.
Shorting cap	Straps battery-pack power into the 628K-1 Receiver-Transmitter. Must be attached in the man-pack configuration, and removed in the vehicular configuration.
Liquid crystal display	Displays PWR, MODE, CHAN/DAY, SQL, and FREQ/NET/TIME with function switch in ON position, and fault information when function switch is in TEST position. Displays battery and receiver-transmitter faults in the NO HOP, HOP, and TIME modes.
AUDIO	
Connector	Five-pin connector for interfacing audio external device. Provides transmit audio in, receive audio out, retransmit, and push-to-talk (ptt) key lines.
Connector	Provides parallel connection to above audio connector.
OFF/TEST/ON/LITE function switch	Permits operator to select one of three functions — OFF, TEST, or ON — with a spring-loaded LITE position for illumination of the display.
VOLUME control	Permits the operator to set the audio output for the most desirable listening level.
Cursor switch ↔	Permits the operator to move the cursor on the liquid crystal display under the function or digit (PWR, MODE, CHAN/DAY, SQL, or FREQ/NET/TIME) that requires change.

Column switch ↕

Permits operator to change the following functions in each column of the liquid crystal display:

PWR: HPA, HI or LO

CHAN/DAY

CHAN: 1 through 9, CHAN is automatically displayed when HOP or NO HOP is selected. CHAN 0 is used for special functions (refer to operating procedures on pages 49).

DAY: 1 through 7, DAY is automatically displayed when the TIME mode is selected. DAY 0 is used for special functions (refer to operating procedures on page 56).

SQL: Either ON or OFF

FREQ/NET/TIME: 30.000 through 87.975 when NO HOP is selected. 000 through 799 when HOP is selected. 00:00 through 23:59 when TIME is selected.

ANTENNA connector

Rf input/output connector, for direct mounting of man-pack antenna or for connecting coaxial cable.

Configure the MP-83 Radio Set for operation in the following manner.

Installation of Vehicular Power Amplifier

- Set POWER switch on front of the 648W-1 Vehicular Power Amplifier to OFF.

- Slide the vehicular power amplifier into position on the MT-1029 Equipment Mounting Base (the equipment mounting base should already be secured to the vehicle) and secure with the two holddown clamps on the front of the mounting base. The power/control plug on the rear of the vehicular power amplifier will automatically mate with the mounting base's connector.

Installation of Receiver-Transmitter

- Set function switch on the front panel of the 628K-1 Receiver-Transmitter to OFF.

- Slide the receiver-transmitter into position on the vehicular power amplifier (the battery and battery-box must be removed prior to this step).

- Secure the receiver-transmitter to the vehicular power amplifier with the two holddown clamps on the front of the vehicular power amplifier.

- Connect power cable from SET PWR connector on the vehicular power amplifier to the PWR connector on the receiver-transmitter.

- Connect coaxial cable from ANT connector on the receiver-transmitter to RF IN connector on the vehicular power amplifier.

Installation of Vehicular Broadband Antenna

- Secure the 938W-1 Vehicular Broadband Antenna to the vehicle.

- Connect coaxial cable from ANT connector on the vehicular power amplifier to the base of the antenna.

Installation of Handset

- Place the handset connector on AUDIO connector located on the front panel of the receiver-transmitter. Ensuring the keying on the plug matches the keying on the receptacle, push and turn clockwise until connector snaps into place.

To verify configuration and radio set performance, set function switch on the receiver-transmitter to TEST and refer to built-in test (BIT).

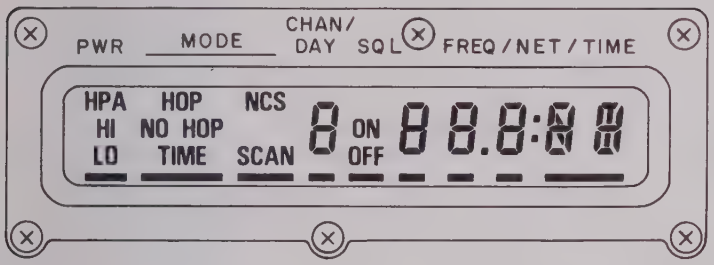
On Vehicular Power Amplifier

- Set power switch to PWR.
- Set speaker switch to OFF.

Receive

On receiver-transmitter, set function switch to TEST.

Display shows all segments of the LCD for 3 seconds.

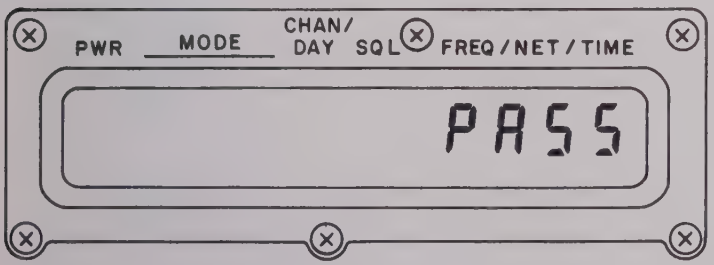


TPA-6166-011

If the receiver is operating properly, the word PASS will be displayed immediately following the 3-second period.

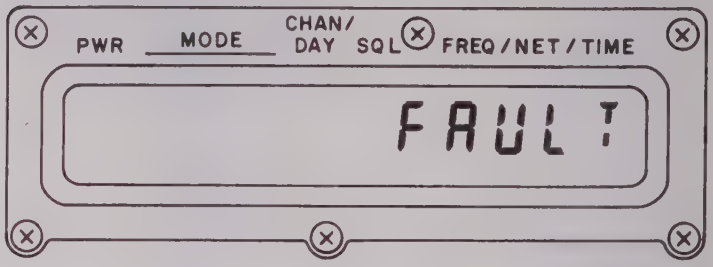
Note

Information on the left-hand portion of the display is not relevant to the built-in test (BIT) but is merely information retained by the memory of the radio set.



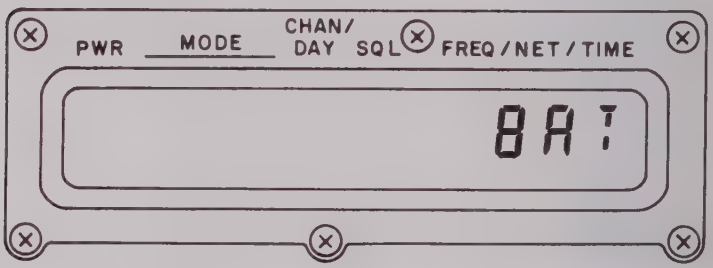
TPA-6323-011

If a fault is detected, the LCD will display faults in the following manner:



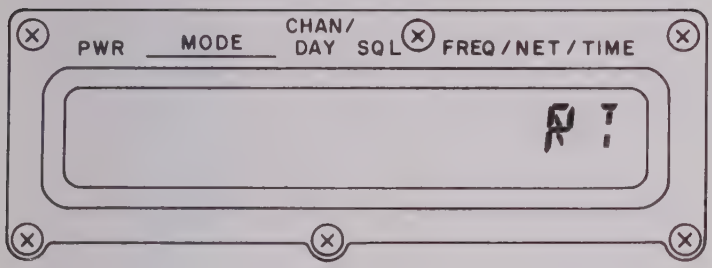
TPA-6322-011

FAULT is displayed alternately with the indicated fault (example: FAULT, BAT, FAULT.....).



TPA-6321-011

FAULT CONDITION	ACTION
Voltage from vehicular power amplifier is less than 10 V dc.	Return vehicular power amplifier for repair.



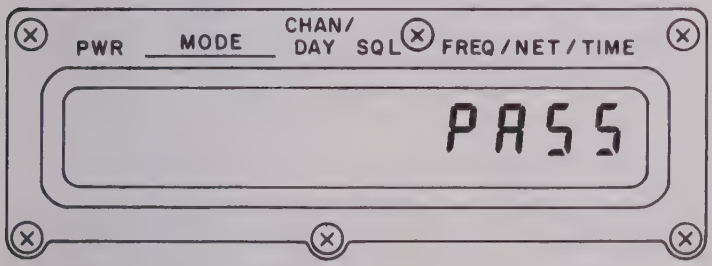
TPA-6320-011

FAULT CONDITION	ACTION
Receiver-transmitter is inoperative.	Return for repair.

Transmit

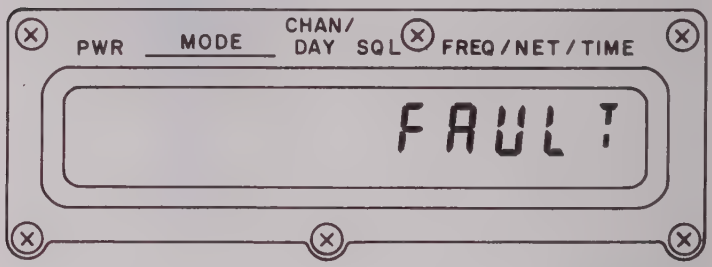
If the push-to-talk (ptt) button on the handset is pressed while in the test mode, the transmit section will be checked.

The LCD will display the word PASS if no fault is detected.



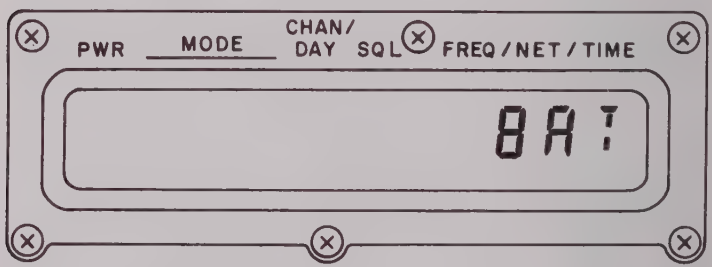
TPA-6323-011

If a fault is detected, the LCD will display faults in the following manner:



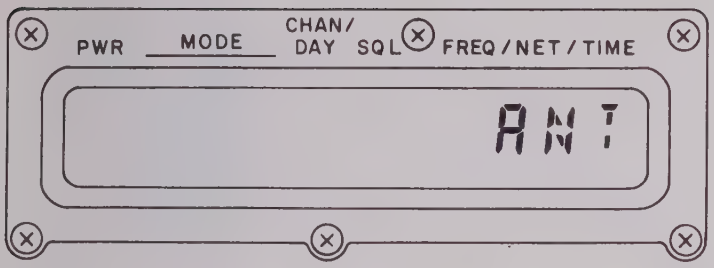
TPA-6322-011

FAULT is displayed alternately with the indicated fault (example: FAULT, RT, FAULT.....).



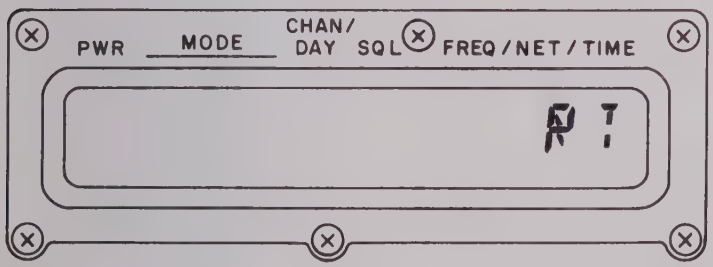
TPA-6321-011

FAULT CONDITION	ACTION
Voltage from vehicular power amplifier is less than 10 V dc.	Return vehicular power amplifier for repair.



TPA-6319-011

FAULT CONDITION	ACTION
Antenna performance has been degraded.	Check physical condition of antenna.



TPA-6320-011

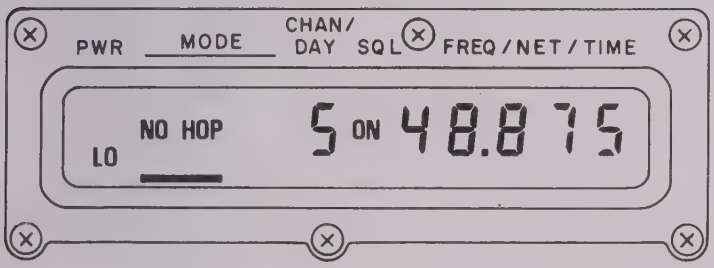
FAULT CONDITION	ACTION
Receiver-transmitter is inoperative.	Return for repair.

Note

If a fault is detected in the 648W-1 Vehicular Power Amplifier, the FAULT indicator light will illuminate when the push-to-talk (ptt) button is pressed. The fault circuitry is reset once the button is released. A fault will be detected whenever the antenna performance is degraded, high temperature limit is exceeded, or the power output of the vehicular power amplifier drops below half power.

Note

Functions called out in the procedures are selected by using the cursor and column switches. To select a function to be changed, first rotate the cursor switch (↔) to position the cursor under the desired function, either PWR, MODE, CHAN/DAY, SQL, or FREQ/NET/TIME. Once the cursor is positioned under the desired function, rotate the column switch (↕) to select the desired operation under that function. An example would be to first rotate the cursor switch to position the cursor under the PWR function and to then rotate the column switch to select either HPA, HI, or LO power.



TPA-6318-011

On vehicular power amplifier

- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

On receiver-transmitter

- Set function switch to ON.
- Set PWR to HPA, HI, or LO.
- Select NO HOP mode.
- Set SQL to ON.
- Set CHAN to 1.
- Use the cursor and column switches to set the desired frequency (30.000 to 87.975 MHz) in the display.
  This frequency is now loaded in preset channel 1.
  Set CHAN to 2.
- Use the cursor and column switches to set the next desired frequency (30.000 to 87.975 MHz) for channel 2.
  This frequency is now loaded in preset channel 2.

To load the remaining 7 preset channels (3 through 9), first select the channel (3, 4, 5, 6, 7, 8, 9) to be loaded, then with the use of the cursor and column switches, select the desired frequency (30.000 to 87.975) for each channel as described above.

If, at a later time, a preset frequency needs to be changed, select the channel to be changed and input the new frequency by using the cursor and column switches. Preset channels are stored in memory and are not lost when the radio set is turned off.

Receive

- Select the desired CHAN.
- Listen to the handset for channel activity and adjust volume control as desired.

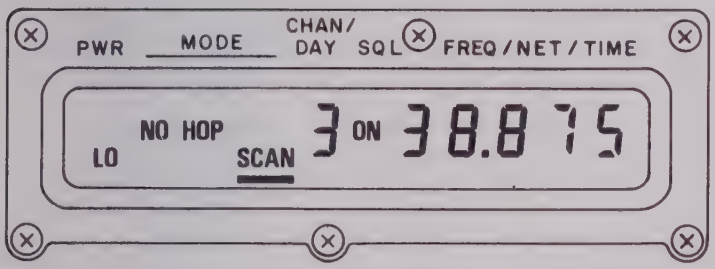
Transmit

- Press the push-to-talk (ptt) button on the handset.
- Talk in a normal volume with mouth touching handset.
- Release push-to-talk (ptt) button when message is complete.

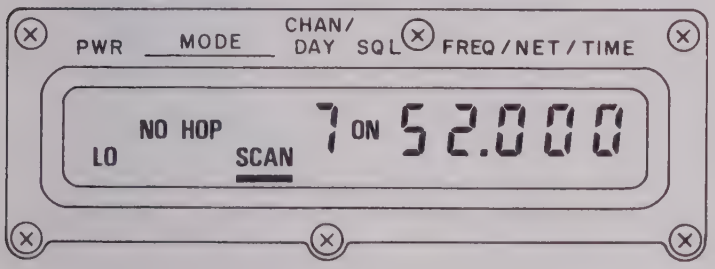
When communicating with MP-83 Radio Sets or other vhf-FM-type radio sets having a 150-Hz tone squelch, the SQL should be set to ON. This eliminates the loud noise in the handset when no station is being received. If communication is required between the MP-83 Radio Set and a radio set that does not have a 150-Hz tone squelch, the SQL should be set to OFF.

PWR should be set to LO for short-range (less than 1 km (0.62 mi)) communications. Set PWR to HI for medium-range (8 km (4.97 mi)) communication. For maximum-range communication, set PWR to HPA (35 km (21.75 mi)).

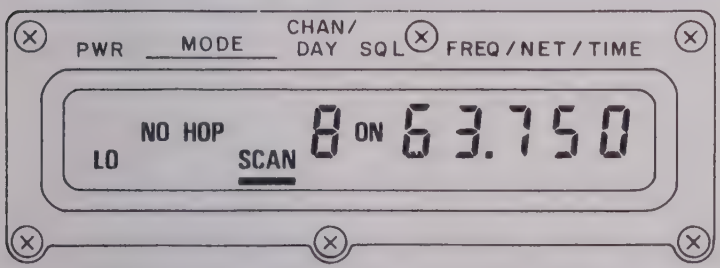
If the operator wishes to manually select an operating frequency, position the cursor under each digit and alter accordingly with the column switch. It should be noted that any alteration of a particular frequency changes the preset frequency of that channel. Therefore, it is suggested that a list of the preset channels be kept by the operator in case an alteration of the preset frequencies is required.



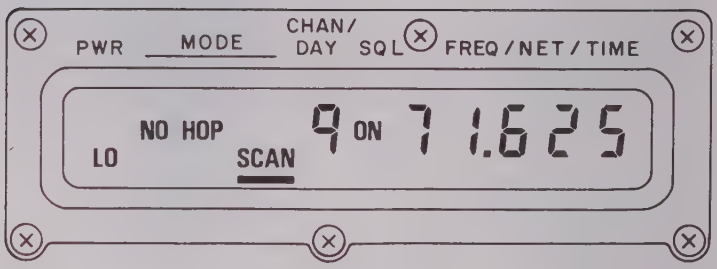
TPA-6234-011



TPA-6748-011



TPA-6749-011



TPA-6750-011

On Vehicular Power Amplifier

- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

On receiver-transmitter

- Set function switch to ON.
- Set PWR to HPA, HI, or LO.
- Select NO HOP mode.
- Verify that preset channels 7, 8, and 9 are loaded with the desired channel frequencies.
  SQL is automatically set to ON when the SCAN mode is selected.
- Select CHAN for the desired preset command (primary operating) channel (1 through 9).
- Select SCAN mode.

In the SCAN mode, the selected preset command channel, along with preset channels 7, 8, and 9, is scanned. When a signal is received, the receiver will lock on that station and remain until 3 seconds after the station stops transmitting, then resume scanning. During reception on a preset other than the command channel, the receiver continues to automatically monitor the command channel. Should activity be detected on the command channel while receiving on a different preset channel, a beep tone will be heard in the operator's handset once every second. To listen to the command channel, the operator must abort reception on the other preset channel by pressing and

releasing the push-to-talk (ptt) button on the handset. SCAN will then retune his radio set to the command channel in the receive mode.

The operator may respond to a preset channel (7, 8, 9) by pressing the push-to-talk (ptt) button on the handset within 3 seconds after receiving a message. After transmission, the radio will resume scanning.

The operator may transmit on the command channel at any time while in the SCAN mode. Any time the receiver is scanning or receiving a message with no beeping tone, pressing the push-to-talk (ptt) button on the handset will cause a transmission on the command channel. If the receiver is within the 3-second timeout or receiving a channel with a beeping tone, a second pressing of the push-to-talk (ptt) button on the handset is required to cause transmission on the command channel. All transmissions on the command channel are preceded with a sidetone beep in the headset. Any change of the display cursor or column switches will abort SCAN and return the display to the command channel selected prior to SCAN.

By loading the same frequency in more than one preset channel, it is possible to reduce the number of channels (frequencies) scanned.

Frequency Hopping (HOP) — Introduction

Operation of MP-83 Radio Sets in frequency hopping (HOP) mode requires the use of net identifiers which are similar to disciplines typically exercised in military communication nets. The net may consist of two or more members, one of which is designated the net controller. The net controller has responsibility for establishing and controlling the communications nets. The procedures of setting up a fixed frequency (NO HOP) net are the same with MP-83 Radio Sets as they are with any family of fixed frequency radio sets, such as the PRC-77 Radio Set and the VRC series of equipment. The net controller has the added responsibility of establishing and maintaining net time for the frequency hopping (HOP) net. In a fixed frequency (NO HOP) net, all radios must be set up to operate on the same frequency. In a frequency hopping (HOP) net, all radios must be set up to operate with the same frequency hopping pattern and with the same time reference. The frequency hopping (HOP) pattern is determined by the net identifier and key number. The time reference is the time maintained in each radio by the internal clock.

The procedures for loading net identifiers and loading the key number are given on pages 48 and 49. The net controller is responsible for coordinating the setting of all radio set internal clocks to a common time (net time). Two techniques for setting time in a radio set are available; one is a manual time loading similar to setting a watch, page 50, and the other is a procedure for transferring time from one radio set to one or more radio sets through a radio transmission, pages 55 and 56.

The net controller may use one or a combination of both time entry techniques to set time in his radio set and to set the same time in all the radio sets that are to be members of the frequency hopping net. (Note: If manual time setting is used, an accuracy of ±10 seconds must be achieved.)

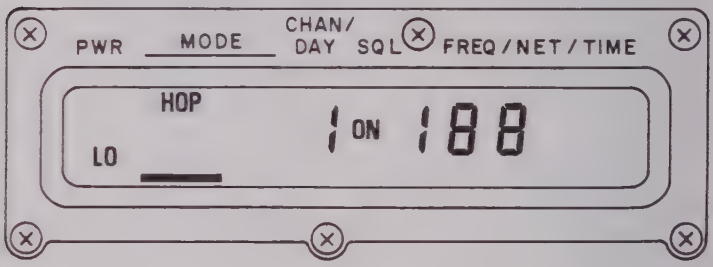
After a frequency hopping net is set up, the net controller must maintain time within the net so that net members will not lose the ability to communicate in the net due to the internal clock of the radio set operating too fast or too slow and developing a time error in excess of ±10 seconds. The net controller will maintain time throughout the net by setting his radio set in the net control station (NCS) mode, page 51. (NCS mode can only be selected in HOP mode). Each time the net controller transmits a message, all receivers receiving that message will automatically receive a time update, resetting their internal clocks. No other action is required to maintain net time.

A non-net member may contact the net controller of the hopping net by transmitting on the fixed frequency, which is the assigned PAGE frequency of the hopping net. An alert signal will be provided to the net controller in the hopping net and, by switching from HOP mode to NO HOP mode, the net controller can communicate with the non-net member on the page frequency. A non-net member equipped with an MP-83 Radio Set may request a radio-to-radio time transfer, load the proper net identifier and key number, and join the hopping net.

Frequency Hopping (HOP)

Before MP-83 Radio Sets can communicate with each other in the HOP mode, all radio sets must be set up with a common 3-digit net identifier, a common 4-digit key number, and common time (within ±10 seconds).

Setting Net Identifier



TPA-6236-011

On Vehicular Power Amplifier

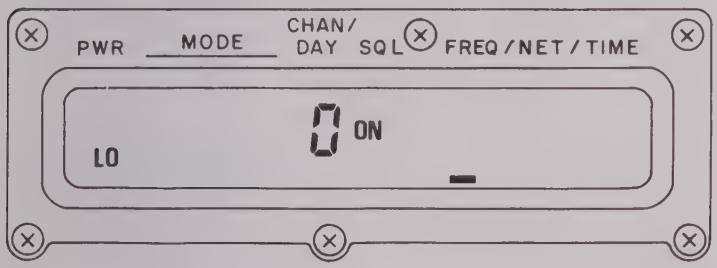
- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

On Receiver-Transmitter

- Set function switch to ON.
- Set PWR to HPA, HI, or LO.
- Select HOP mode.
- Set CHAN to 1.
- Using the cursor and column switches, select the net identifier (000 to 799) for channel 1.
- Set CHAN to 2.
- Using the cursor and column switches, select the net identifier (000 to 799) for channel 2.

To load the remaining 7 channels (3 through 9), first select the channel (3, 4, 5, 6, 7, 8, 9) to be preset, then by using the cursor and column switches, select the net identifier (000 to 799) for each channel. Load page frequency assigned to each hopping net identifier in the associated fixed frequency preset channel.

Key Number Loading

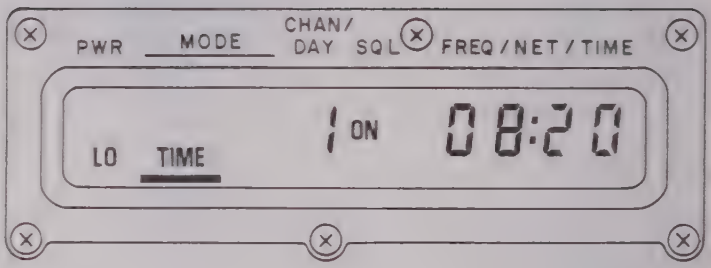


TPA-6747-011

- Set CHAN to 0.
  No digits will be displayed on the liquid crystal display when channel 0 is first selected.

- Rotate the cursor and column switches to set the key number (0000 to 9999).

The key number loaded is common for all preset channels (1 through 9). Should it be necessary to change the key number, set CHAN to 0 and, by using the cursor and column switches, load the new key number.



TPA-6316-011

- Select TIME mode.
- Set DAY (1 through 7).
- Set hour (00 through 23).
- Set minute (00 through 59) to within 1 minute of desired time.
- As the time source starts a new minute, rotate the column switch to set the new minute on the radio set. Seconds are reset to 00 automatically every time the minute number changes.
- Time is now entered in the radio set.

The time source will be designated by the net control station (NCS). For automatic transfer of time, use procedure for TIME on pages 55 and 56.

Net Control Station (NCS)

One station within each frequency hopping net is designated net control station (NCS) and must have NCS mode selected. The NCS has the responsibility of establishing, maintaining, and controlling the net.

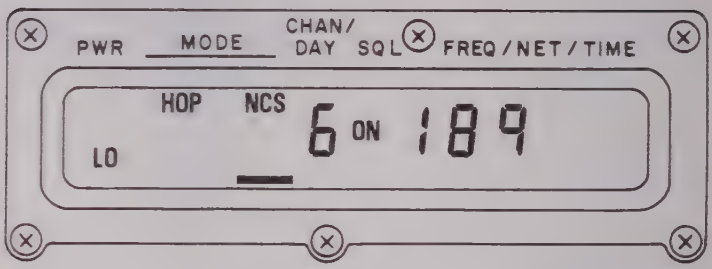
To establish a net, the NCS may either designate a time source to be manually loaded into the net radio sets, page 50, or use the TIME procedure, page 55, to automatically transfer NCS time into the net radio sets.

To maintain net time, the NCS must communicate with the net periodically. All non-NCS radio sets will automatically have their time updated after receiving normal communication from the NCS. Net time may be maintained for 48 hours without NCS update.

To control the net, the NCS is the only radio set having the capability to recognize PAGE messages received from non-hopping radio sets. Refer to the NCS radio set receiving PAGE procedures on page 54. If late net entry is requested, the NCS has the option of bringing the requester into the net using TIME procedures, page 56.

If NCS receives a transmission from another NCS, a "beep" will precede the message to alert the NCS operator. The time in either radio set will not be updated or altered.

Radio Set in HOP, NCS Mode



TPA-6235-011

On Vehicular Power Amplifier

- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

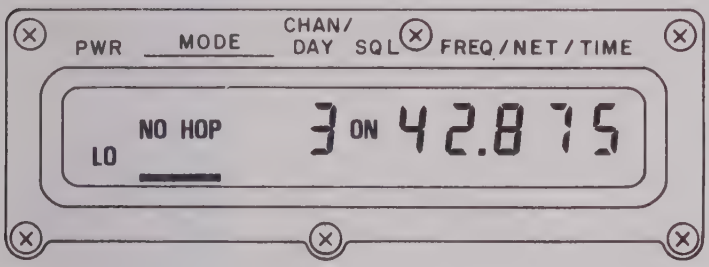
On Receiver-Transmitter

- Set function switch to ON.
- Set PWR to HPA, HI, or LO.
- Select HOP mode.
- Select CHAN 0.
- Select NCS mode.
- Select preset channel (1 through 9).
- Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit, and releasing the button to receive.

Paging a Net Control Station Radio Set (PAGE)

Paging is used by a radio set in NO HOP to request communications with the net control station (NCS) of a hopping net.

Radio Set Transmitting PAGE



TPA-6238-011

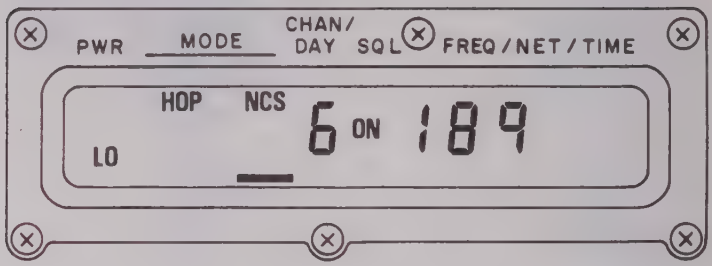
On Vehicular Power Amplifier

- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

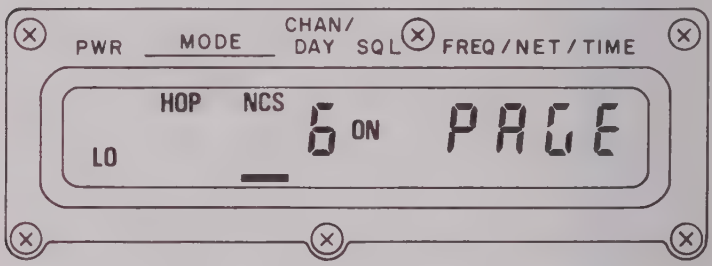
On Receiver-Transmitter

- Set function switch to ON.
- Set PWR to HPA, HI or LO.
- Select NO HOP mode.
- Select preassigned page channel.
- Set SQL to ON or OFF.
- Press push-to-talk (ptt) button on handset for approximately 3 seconds to initiate paging.
- Voice communication is not necessary. Allow time for NCS or designated net member to respond in NO HOP mode. If late net entry is desired, follow time procedure of Radio Set Requesting/Receiving Time, page 56.

NCS Radio Set Receiving PAGE



TPA-6235-011



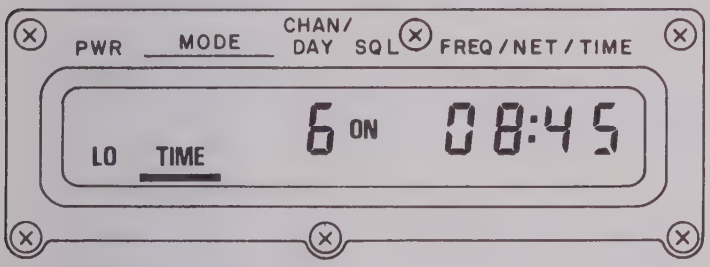
TPA-6239-011

The word PAGE is observed flashing alternately with the net identification number on the LCD. A beeping tone (2 kHz) cycles every 12 seconds if SQL is ON.

- Select the NO HOP mode to communicate with other operator on page channel.
- If late net entry is desired by pager, follow TIME procedure of Radio Set Transmitting Time, page 55.
- To remove tone, set SQL to OFF. The word PAGE will continue to flash as long as paging activity persists. Pressing the push-to-talk (ptt) button on the handset overrides the PAGE indication while transmitting.

Transfer of time in this mode requires that both the radio set sending time and the radio set or radio sets receiving time must first be set up to operate on the same frequency in NO HOP mode and then switched to TIME mode. This coordination may be accomplished using fixed frequency communication or any other available signaling techniques.

Radio Set Transmitting Time



TPA-6237-011

On Vehicular Power Amplifier

- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

On Receiver-Transmitter

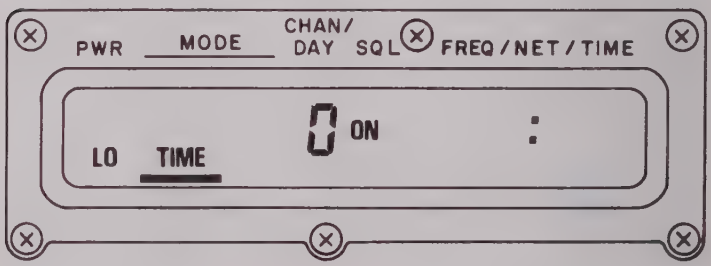
- Set function switch to ON.
- Set PWR to HPA, HI, or LO.
- Select NO HOP mode.
- Set to preassigned page frequency.
- Establish voice communication with time requester or coordinate by any available means.
- Select TIME mode.

Note

When unit is in TIME mode, it will receive TIME mode transmissions only, and not HOP or NO HOP mode communications.

- Transmit a message to time requester. Time is automatically updated in the requester's radio set at the end of transmission.
- Continue voice communication in TIME mode to confirm time was received and coordinate switching to HOP mode.
- Select HOP mode.
- Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit, and releasing the button to receive.

Radio Set Requesting/Receiving Time



TPA-6317-011

On Vehicular Power Amplifier

- Set power switch to PWR.
- Set speaker switch to SPKR if the loudspeaker is desired.

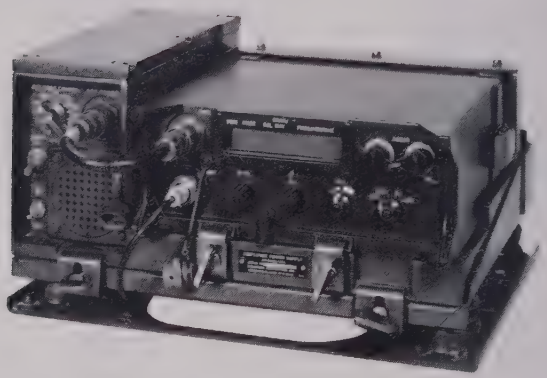
On Receiver-Transmitter

- Set function switch to ON.
- Set PWR to HPA, HI or LO.
- Select NO HOP mode.

- Set to preassigned page frequency.
- Establish voice communication with another operator and request time update or coordinate by any other means.
- Select TIME mode.
- Set DAY to 0. Time display will be blank except for colon.
- Proceed with voice communication. The radio set will be updated at the beginning of the time transmitter's transmission, but time will not be displayed until the end of his transmission.
- Acknowledge to transmitter that time has been received and coordinate switching to HOP mode.
  Continued two-way voice communication is possible without changing time in either radio set.
- Select HOP mode.
- Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit, and releasing the button to receive.

SPECIAL APPLICATIONS

MP-83 Radio Set Operation in the AM-2060/GRC Amplifier-Power Supply



- Set PWR switch on amplifier-power supply to ON.
- Set SPKR switch on amplifier-power supply to ON, if loudspeaker is desired.
- Set function switch on receiver-transmitter to ON.
- If applicable, set ANT FREQ CONTROL switch to the desired bandwidth required for fixed frequency or frequency hopping operation. Refer to the following notes.

Note

A broadband vehicular antenna (938W-1 Vehicular Broadband Antenna) may be used, thus permitting full-band frequency hopping for the radio set. When a broadband vehicular antenna is used, the ANT FREQ CONTROL switch on the AM-2060/GRC Amplifier-Power Supply is nonoperational.

Note

When an AS-1729 Antenna is used, narrow-band hopping net operation is possible. Select the frequency plan with the proper bandwidth, then set ANT FREQ CONTROL switch on the AM-2060/GRC Amplifier-Power Supply to the corresponding bandwidth.

Proceed with normal voice communication by pressing the push-to-talk (ptt) button on the handset to transmit and releasing the button to receive.

High-power output of the receiver-transmitter is automatically limited to 2.5 W due to limitations in the amplifier-power supply.

MP-83 Radio Set Radio Relay Using Electrical Cable Assembly CX-4656/GRC

Two MP-83 Radio Sets may be configured as a radio relay station to extend the communication range of radios using the relay. The relay link is accomplished by an rf link (F1) between radio sets no 1 and no 2, a baseband frequency link between radio sets no 2 and no 3, and an rf link (F2) between radio sets no 3 and no 4. The relay may be used by radios in either the NO HOP, HOP, or TIME mode; however, NCS update in the HOP mode or automatic time transfer in the TIME mode is not provided between radio sets no 1 and no 4. Any combination of modes may be used providing that the radio sets interfacing with the rf links, F1 and F2, are using common modes. For example, radio sets no 1 and no 2 may be operating in the NO-HOP mode while radio sets no 3 and no 4 are operating in the HOP mode.

To minimize interference at the relay site, the requirements for selecting the two rf links, F1 and F2, are as follows:

- F1 and F2 must be separated by a frequency band that is equal to or greater than 10% of the highest frequency of the two.
- Either F1 or F2 must not be double the frequency of the other.
- Either F1 or F2 must not equal the other plus 13.5 MHz.
- Either F1 or F2 must not equal the other plus 27.0 MHz.

To summarize:

- For F1 $>$ F2, F1 $\geq$ 10% F1 + F2
  For F2 $>$ F1, F2 $\geq$ 10% F2 + F1
- F1 $<>$ 2F2, F2 $<>$ 2F1
- F1 $<>$ F2 + 13.5 MHz, F2 $<>$ F1 + 13.5 MHz
- F1 $<>$ F2 + 27.0 MHz, F2 $<>$ F1 + 27.0 MHz

To establish initial relay link, use the following procedures.

On radio sets no 1, no 2, no 3, no 4:

- Set function switch to ON.
- Set PWR to HI.
- Select NO HOP or HOP mode.
- Set SQL to ON.

On radio sets no 1 and no 2:

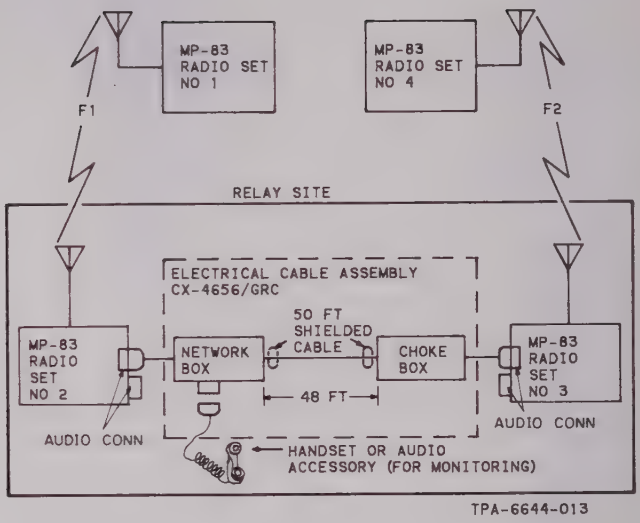
- Set CHAN to desired operating channel/net (F1).
- Establish voice communication between radio sets and verify that squelch is satisfactory.
- Advise radio set no 1 to stand by.

On radio sets no 3 and no 4:

- Set CHAN to desired operating channel/net (F2).
- Establish voice communication between radio sets and verify that squelch is satisfactory.
- Advise radio set no 4 to stand by.

On radio sets no 2 and no 3:

- Connect the connectors on each end of the Electrical Cable Assembly CX-4656/GRC to the AUDIO connector on radio sets no 2 and no 3 as shown in the following figure.



- Establish communication between radio sets no 1 and no 2 and advise radio set no 1 that the relay site is prepared for communication with radio set no 4.

Note

To communicate with radio set no 1 or no 4, the operator at the relay site must have a handset connected to the spare AUDIO connector on the relay site radio associated with the distant radio set.

- Establish communication between radio sets no 3 and no 4 and advise radio set no 4 that the relay site is prepared for communication with radio set no 1.

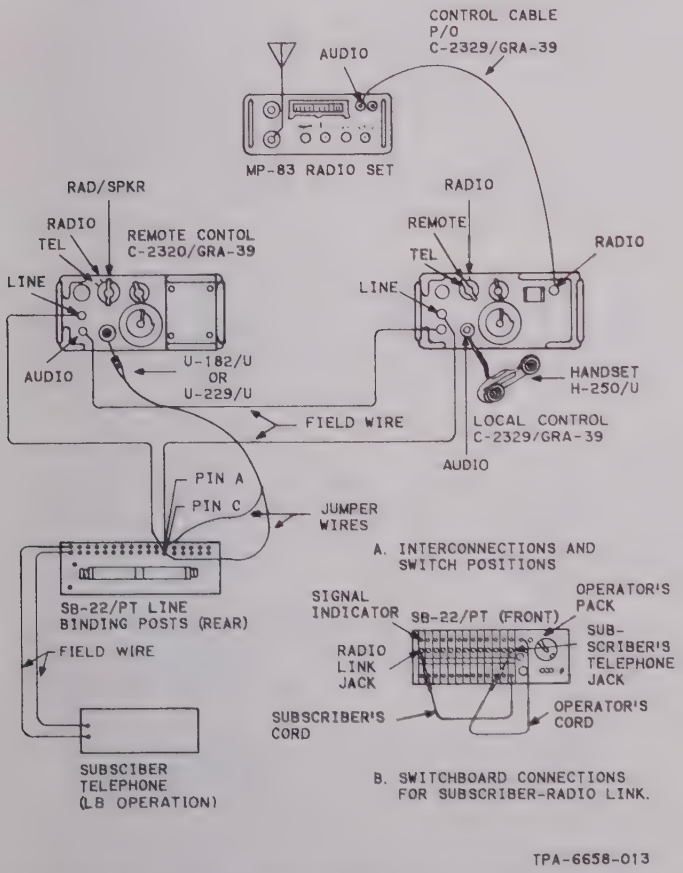
Communication proceeds automatically between radio sets no 1 and no 4 without any operation required at the relay site.

To enable the operator at the relay site to receive instructions and to monitor communications between radio sets no 1 and no 4, a handset may be connected to either of the spare AUDIO connectors on radio sets no 2 and no 3 or to the audio connector on the network box of the cable assembly.

MP-83 Radio Set Remote Control Using Radio Set Control AN/GRA-39

The Radio Set Control AN/GRA-39 provides remote radio set control of the transmissions and receptions of the MP-83 Radio Set for up to 3.3 km (2 mi) and also enables radio wire integration (RWI) between the Telephone Switchboard SB-22/PT and the radio set.

Operation of the MP-83 Radio Set as described in the operating procedures is unchanged. The Radio Set Control AN/GRA-39 with radio wire integration is connected as shown.



Set the switches on the remote control boxes as shown.

Since the remote control is set up at the switchboard, the switchboard operator will respond to calls from the distant radio set with the push-to-talk (ptt) button of his handset using proper radio communication procedures. In effect, the switchboard operator becomes the radio set operator.

When the radio set's call signal is heard on the loudspeaker of the remote control, proceed as follows:

- Insert the operator's cord into the radio set link jack and determine the desired subscriber.
- Advise the distant radio set to stand by.
- Connect the operator's cord to the subscriber's jack.
- Ring and notify the subscriber of the call. (The subscriber should be reminded to ring back when the call is completed.)
- Connect the subscriber's cord to the radio set link jack.

Note

Positioning of the switchboard handset switch to the RADIO position on the remote control while the operator's cord is connected to the subscriber's jack will key the radio set.

- Remove the operator's cord from the subscriber's jack.

The incoming radio set communication can be heard on the remote control's loudspeaker, the subscriber's voice cannot be heard.

When the subscriber's signal indicator on the switchboard shows white, proceed as follows:

- Insert the operator's cord into the subscriber's jack without operating the switchboard handset switch to the RADIO position. Question the subscriber to determine if the circuit is still required.
- If the call is complete and the circuit is no longer required, remove the subscriber's cord from the radio set link jack.

Frequency range	30 to 87.975 MHz in 25-kHz steps (2320 channels)
Preset channel selection	9 preset channels available for NO HOP/fixed frequency
	9 preset channels available for antijam HOP/ frequency hopping

Modes of operation

NO HOP	Fixed frequency communications with vhf, 30- to 87.975-MHz FM radio sets.
SCAN	Available in NO HOP only, compatible with receiver-transmitters with 150-Hz squelch tone, scans preset channel presently selected on display plus three additional channels — presets 7, 8, and 9.
HOP	104 frequency hops per second on any frequency between 30.000 and 87.975 MHz, on 25-kHz channel spacing. Digital voice and digital data, between two 628K-1 Receiver-Transmitters, bursted 20-kb/s data with resynchronization every second.
NCS	Available in HOP only, net control station (NCS) automatically provides time update with each transmission for non-NCS stations to update their internal digital quartz clocks.
TIME	Fixed frequency automatic time transfer and digital voice between two 628K-1 Receiver-Transmitters, bursted 20-kb/s data.

ECCM

Net Identifier	800 ECCM net identifiers (000 to 799)
Key Number	10 000 ECCM key numbers (0000 to 9999)
Hopping rate	104 hops/second

Power output

Man-Pack	Selectable 5 W or 0.25 W
Vehicular	Selectable 50 W, 5 W, or 0.25 W

Primary power

Man-Pack	Input voltage between 10 and 15 V dc. Power consumption at 12.5 V dc input voltage is less than: 2.5 watts — receive 11.3 watts — low power transmit (0.25 W) 28 watts — high power transmit (5 W)
Vehicular	Input voltage of +25.5 V dc. Power consumption at 25.5 V dc input voltage is 250 watts.

Dimensions

Man-Pack	
Width	28 cm (11 in)
Height	10 cm (4 in)
Depth	28 cm (11 in)
Vehicular	
Width	40.5 cm (15.9 in)
Height	22.9 cm (9.1 in)
Depth	35.3 cm (13.9 in)

Weight

Man-Pack	6.8 kg (14.9 lb) — includes antenna, battery, and handset
Vehicular	19.9 kg (43.9 lb) - includes receiver-transmitter

Temperature	–40 to +66 °C (–40 to +151 °F)
Humidity	0 to 100% for ten days
Altitude	4572 m (15 000 ft)
Submersion	Down to 1.00 m (3.3 ft)

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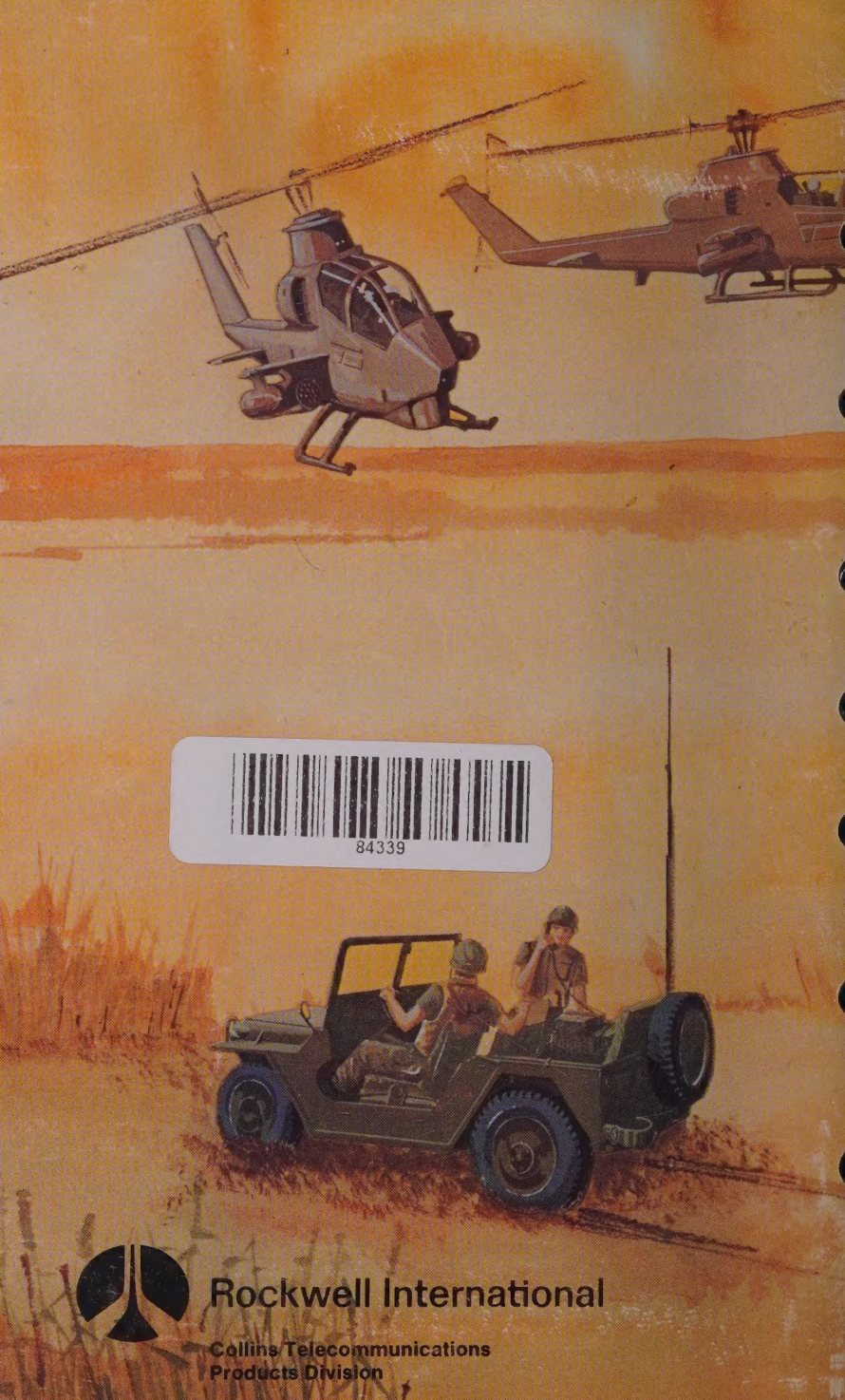

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